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ANALYSING THE PROPOSED HANDOVER APPROACH FOR WI FI AND WIMAX

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ABSTRACT

A wireless network in which, computer devices communicates with each other without any wire. The communication medium between the computer devices is wireless. When a computer device wants to communicate with another device, the destination device must lays within the radio range of each other. Users in wireless networks transmit and receive data using electromagnetic waves. Recently wireless networks are getting more and more popular because of its mobility, simplicity and very affordable and cost saving installation. the architecture of WiMAX network and important functional entities and interfaces between these entities like base station (BS), Access service network (ASN) gateway and how it supports connection and mobility management across cell sites and inter-service provider network boundaries. Our work starts with problem formulation and implementation, giving the idea about the methodology used to solve the problem of efficient heterogeneous network handover and gives details of the factors involved in handover decision. In includes the proposed algorithm along with the proposed work description with parameter specification.

KEYWORDS: wireless network, WiMAX, ASN, mobility, heterogenous, handover.

INTRODUCTION

Wireless networks are gaining popularity to its peak today, as the user wants wireless connectivity irrespective of their geographic position. Wireless Networks enable users to communicate and transfer data with each other without any wired medium between them. One of the reasons of the popularity of these networks is widely penetration of wireless devices. Wireless applications and devices mainly emphasize on Wireless Local Area Networks (WLANs). This has mainly two modes of operations, i.e. in the presence of Control Module (CM) also known as Base Stations and Ad-Hoc connectivity where there is no Control Module. Ad-Hoc networks do not depend on fixed infrastructure in order to carry out their operations. The operation mode of such network is stand alone, or may be attached with one or multiple points to provide internet and connectivity to cellular networks. These networks exhibits the same conventional problems of wireless communications i.e. bandwidth limitations, battery power, enhancement of transmission quality and coverage problems.

Network:

Before going into the details of wireless network, it is important to understand what a network is and different kind of networks available today. Any collection of devices/ computers connected with each other by means of communication channels that help the users to share resources and communicate with other users. There are two main types of network i.e. wired network and wireless network.

THEORETICAL DEVELOPMENT

Architecture of WiMAX:

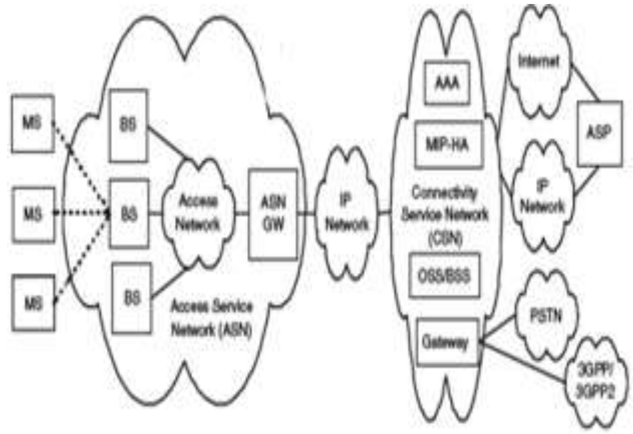
The network reference model envisions unified network architecture for supporting fixed and mobile deployments and is based on an IP service model. Below is simplified illustration of IP-based WiMAX network architecture. The overall network may be logically divided into three parts[37]:

- Mobile Stations (MS) used by the end user to access the network.
- The access service network (ASN), which comprises one or more base stations and one or more ASN gateways that form the radio access network at the edge.
- Connectivity service network (CSN), which provides IP connectivity and all the IP core network functions.

The network reference model developed by the WiMAX Forum NWG defines a number of functional entities and interfaces between those entities. Fig below shows some of the more important functional entities[37].

- Base station (BS): The BS is responsible for providing the air interface to the MS. Additional functions that may be part of the BS are micro mobility management functions, such as handoff triggering and tunnel establishment, radio resource management, QoS policy enforcement, traffic classification, DHCP (Dynamic Host Control Protocol) proxy, key management, session management, and multicast group management[37].
- Access service network gateway (ASN-GW): The ASN gateway typically acts as a layer 2 traffic aggregation points within an ASN[38]. Additional functions that may be part of the ASN gateway include intra-ASN location management and paging, radio resource management and admission control, caching of subscriber profiles and encryption keys, AAA client functionality, establishment and management of mobility tunnel with base stations, QoS and policy enforcement, and foreign agent functionality for mobile IP, and routing to the selected CSN[39].
- Connectivity service network (CSN): The CSN provides connectivity to the Internet, ASP, other public networks, and corporate networks. The CSN is owned by the NSP and includes AAA servers that support authentication for the devices, users, and specific services. The CSN also provides per user policy management of QoS and security[40].

The WiMAX architecture framework allows for the flexible decomposition and combination of functional entities when building the physical entities. For example, the ASN may be decomposed into base station transceivers (BST), base station controllers (BSC), and an ASNGW analogous to the GSM model of BTS, BSC, and Serving GPRS Support Node (SGSN)[40].



IP Based WiMAX Architecture[40]

Implementation of WiMAX

WiMAX is one of the hottest broadband wireless technologies around today. These systems are expected to deliver broadband access services to residential and enterprise customers in an economical way. Loosely, it is a standardized wireless version of Ethernet intended primarily as an alternative to wire technologies to provide broadband access to customer premises[41]. More strictly, it is an industry trade organization formed by leading communications component and equipment companies to promote and certify compatibility and interoperability of broadband wireless access equipment that conforms to the IEEE 802.16. It would operate similar to Wi-Fi but at higher speeds, over greater distances and for a greater number of users[37]. It has the ability to provide service even in areas that are difficult for wired infrastructure to reach and the ability to overcome the physical limitations of traditional wired infrastructure.

It is to implement the security issues in WiMAX. The application we implement is the security in WiMAX using encryption and decryption schemes. During packet transferring in WiMAX technology, security is an issue. In this dissertation we implement the data security in WiMAX. The figure 3.1 shows a simple position of base stations and mobile stations. When packet is transferred from one mobile station of one cluster to another mobile station of another cluster, then center base station always help to transfer the packet. That means the communication between stations always pass through the center base station.

A WiMAX system consists of the following major parts:

- A WiMAX base station.

- A WiMAX receiver.
- WiMAX Base Station.

WiMAX base station: It consists of indoor electronics and a WiMAX tower similar in concept to a cell-phone tower. A WiMAX base station can provide coverage to a very large area up to a radius of 6 miles. Any wireless device within the coverage area would be able to access the Internet. The WiMAX base stations would use the MAC layer defined in the standard. It is a common interface that makes the networks interoperable and would allocate uplink and downlink bandwidth to subscribers according to their needs, on an essentially real-time basis. Each base station provides wireless coverage over an area called a cell. Theoretically, the maximum radius of a cell is 50 km or 30 miles however, practical considerations limit it to about 10 km or 6 miles[42].

WiMAX Receiver: A WiMAX receiver may have a separate antenna or could be a stand-alone box or a PCMCIA card sitting in your laptop or computer or any other device. This is also referred as customer premise equipment (CPE). Its base station is similar to accessing a wireless access point in a Wi-Fi network, but the coverage is greater[42].

Working of Wi-Fi

The current Wi-Fi (wireless fidelity) systems based on IEEE 802.11a/g support a peak physical-layer data rate of 54Mbps and typically provide indoor coverage over a distance of 100 feet. Wi-Fi has become the de facto standard for last feet broadband connectivity in homes, offices, and public hotspot locations. Systems can typically provide a coverage range of only about 1,000 feet from the access point. Wi-Fi offers remarkably higher peak data rates than do 3G systems, primarily since it operates over a larger 20MHz bandwidth but Wi-Fi systems are not designed to support high-speed mobility.

Architecture of Wi-Fi

The IEEE 802.11 protocol is a network access technology which provides connectivity between wireless stations and wired networking. It is subdivided into cells and the main components of the architecture are station, wireless access point (AP), basic service set (BSS), independent basic service set (IBSS), distribution system (DS), and extended service set (ESS). Each cell is controlled by a Base Station with a single AP, it performs the function of a bridge between the wireless stations and the existing network backbone (Distribution System) for network access. This Distribution System is typically Ethernet and, in some cases, is wireless itself. Some of the components of the architecture map directly to hardware devices, such as stations and wireless APs. The wireless station contains an adapter card, PC Card, or an embedded device to provide wireless connectivity. An IBSS is a wireless network, consisting of at least two STAs, used where no access to a DS is available. An IBSS is also sometimes referred to as an ad hoc wireless network. A basic service set is fundamental building block of a Wi-Fi network. A BSS is defined as a set of stations controlled by a single Coordination Function or access point. Sometimes it is also referred to as infrastructure wireless network and the geographical area covered by BSS is called basic service area. Conceptually, all stations in a BSS can communicate directly through the AP with all other stations in a BSS. The bridging functionality and connectivity is provided by AP when one station initiates communication with another station or a node on the DS. An IBSS is a formal name of ad hoc network in a Wi-Fi system. It is a grouping of stations into single BSS for internetworked communications without an infrastructure network. Direct communication session can be established by a station with any other station in the BSS and there is no need to send all the traffic through centralized AP. An extended service set, consisting of a set of BSSs, must have a common service set identifier. The BSSs can all work on the same or different channels. This helps to boost the signal throughout the wireless network. An ESS provides gateway access for wireless users into a wired network such as internet. This is accomplished via a device called portal. It provides range extension and translation between different formats.

Problem Formulation

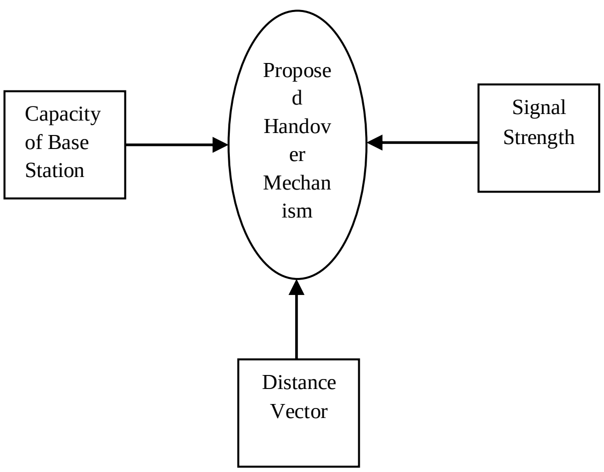
WiMAX and Wi-Fi are the high speed telecommunication technologies that offer transmission of wireless data via a number of transmission methods; such as portable or fully mobile internet access via point to multipoint links. As the size of a Wireless Network is much vast because of this the complete network is divided in terms of clusters. Each cluster having a cluster head or the base station the controls all nodes of the network. As of wireless network these network support the concept of mobility. When the mobility is during data transmission it is more critical. The main problem arise when a node move outside its coverage area, In such case some other base station get the control of the node. This situation is called handover. When the handover is between two different network architecture the selection of the particular base station for the node is more critical.

Sources of Data

To work with WiMAX network we need to define a hybrid network with n number of nodes and m number of clusters. Some cluster will represent the WiMAX network and some will represent the Wi-Fi network. For this we need to collect the information about the network scenario. The scenario includes the information like

- No of Nodes
- Mobility
- Cluster Definition
- Channel Type
- Propagation
- Transmission Speed
- Packet Size

To represent all these parameters we need to collect relevant scenarios. We can collect these scenarios either from some existing literature Surveys or by studying the network definition. We need to collect information about the parameters that can help to decide the cluster head selection such as distance, load etc. These parameters will be decided by study the existing literature.



Factors to perform Handover

in our decision algorithm the decision factor for each candidate BS depends on both factors: idle capacity and signal strength. We have combined the two factors into a weighted target cell decision function as shown in figure

BS Maximum Capacity Evaluation

The first and the foremost task to take the handover decision is to find the base station capacity accurately. The capacity depends on the physical characteristics of the network. To perform this analysis it is required to analyze the OFDM singal over the network and respective parameters. These parameters include the bandwidth, number of carriers, subcarrier, transmission rate etc. We also have to analyze the symbol time that depends on the throughput time and the guard time.

Methodology

MATLAB simulation editor is used for writing the code and implementation of the present work. The results will be shown in the command window of MATLAB.

Vertical Handover

When we work with hybrid networks there are number challenges we face while performing the communication over the network regarding the network security and the efficiency. In such network when a mobile node move outside its current cluster, then there is the requirement of some cluster selection mechanism to elect as the next head for that mobile node. This process is called vertical handover. In this present work, the vertical handover optimization is performed in case of wimax and Wi-Fi networks. The selection of the handover is defined based on some parameteric values. These parameters includes the response time, distance and the throughput analysis.

To calculate total number of OFDM symbols transmitted per frame, first we have to calculate OFDM symbol duration which is given as:

TD_{OFDM} = useful symbol time + guard time

TD_{OFDM} = useful symbol time + G × useful symbol time

$$\mathbf{TD_{OFDM} = [1 / (f_s / N_{FTT})] * (1 + G)} \qquad (1)$$

Where,

NFTT-total no. of sub carriers for OFDM

G-cyclic prefix (CP) ratio

fs (sampling factor) = (bandwidth×144/125)

Idle Capacity Advertisement

Once the capacity is evaluated accurately the next work is to analyze the throughput over the network. The throughput is based on the current signal strength That is That is again affected by different parameters. These parameters include the load or the congestion over the network. On the bases of these two parameters the idle time is calculated for the base station and the network. Through statistics a BS is also aware of the current data traffic throughput. Therefore, each BS could obtain the effective idle capacity is given as:

$$\mathbf{C_i = C_{effective} - C_{throughput}} \qquad (2)$$

Handover Trigger

The handover triggering refers to the concept of shifting the control of a mobile node from one base station to other. There are different decision parameters are suggested by different researchers to perform the handoff process. Most common parameters used by the researchers is distance vector. It means the base station which is closer to the mobile node will get the control over the node. It also signifies the lesser the distance more clear and strong the signal will be. Another parameter is the throughput. The throughput represents the output driven by the mobile node during the handover process. It depends on the load on the base station. The congestion vector also influences the handover triggering. In this work we have taken these all parameters collectively to perform the decision making.

Target Cell Decision

In this proposed work we have taken the following parameters

- Distance as the Probabilistic parameter
- Load on the Base Station
- Signal Strength
- Throughput

In this present work we have taken these parameters collectively. Some parameters are directly considered and some are being concerned as the hidden parameters such as congestion ratio etc. The main concern here is the delay analysis. The delay analysis is based on the network capacity and the load. Respective to that the throughput is analyzed and the delay is estimated.

RESULTS AND DISCUSSION

Network Setup:

The simulation scenario consists of a test area covered by WiMAX BS, and MSs which are randomly dispersed in the test area with overlapped contiguous areas. The position of each MS is random but there are ten MS served by each BS. The traffic model that each MS requests is a non real time Polling Service (nrtPS) at 50 kbps. Table 1 lists the main parameters of the simulation scenario.

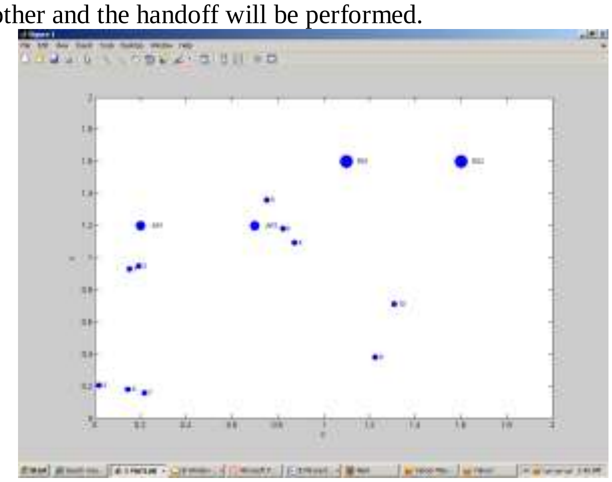
Table 1: Simulation Parameters

PARAMETER	VALUE
Frequency Band	5 MHz OFDM
Modulation Scheme	1/2 BPSK
No. of BS	2
No. of MS	10
Simulation duration	20 s
Requested data rate	50 kbps
BS coverage	1000 m
Frame duration	20 ms
MS Speed	20 m/s

In the present scenario standard 5 MHz OFDM frequency is used with requested data rate of 50 kbps. OFDM is a frequency division multiplexing technique (FDM) scheme used as a digital multicarrier modulation method. Frequency division multiplexing method (FDM) is a technology that transmits multiple signals simultaneously over a single transmission path, such as a cable or wireless system. Each signal travels within its own unique frequency range (carrier), which is modulated by the data (text, voice, video etc.). Orthogonal FDM's (OFDM) spectrum technique distributes the data over a large number of carriers that are spaced apart at precise frequencies. This spacing provides the orthogonality in this technique which prevents the demodulators from seeing frequencies other than their own. The data is divided into several parallel streams or channels, one for each sub-carrier. Each sub-carrier is modulated with a conventional modulation scheme at a low symbol rate, maintaining total data rates similar to conventional single-carrier modulation schemes in the same bandwidth. The benefits of OFDM are high spectral efficiency, resiliency to RF interference and lower multiple channels (i.e. the transmitted signal arrives at the receiver using various paths of different lengths). Since multiple versions of the signal interference with each other (inter symbol interference (ISI)) it becomes very hard to extract the original information. OFDM is sometimes called multi-carrier or discrete multitone-modulation.

Results

The figure is showing the WiMAX and Wi-Fi networks with n number of nodes and two base stations. To show the concept of heavy load we have taken a multicast communication. The node will move from one network to other and the handoff will be performed.

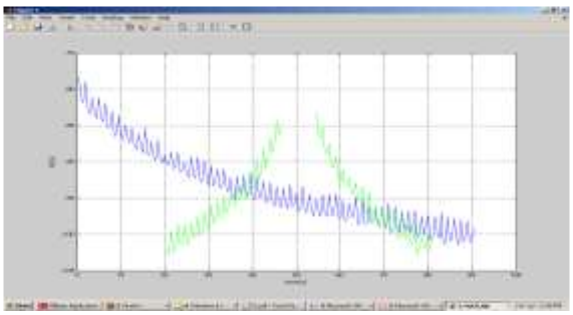


Network Setup

As we can see the hybrid network with n mobile stations and 2 base stations one for the Wi-Fi network and WiMAX network. The basic parameters considered here for the handoff analysis are Mobile Node Speed and the Distance vector. The results are driven in the form of error and the BER detection for the network.

Signal Strength for WIMAX and Wi-Fi Networks (Case 1)

In this particular network the MS is moving outside the network (BS) at speed 10m/s and enters a Wi-Fi network, the probabilistic vector for the distance is (.1) 100 m. As the MS moves away the signal strength goes on decreasing from higher value of -80dbm w.r.t. vector distance. Handover occurs to Wi-Fi network when the signal strength of BS decreases considerably to a lower level approx. -94dbm and when the signal strength of Wi-Fi network is higher than the WiMAX network. The obtained results show a throughput error value 19 and BER value is 0.0586.

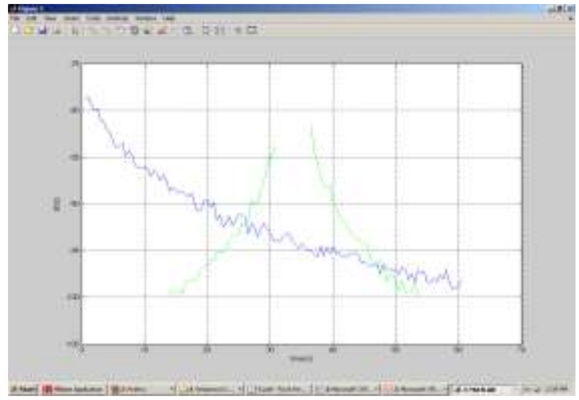


Signal Strength for WiMAX and Wi-Fi Network

The strength of the signals for the Wi-Fi and the WiMAX network is shown in figure 5.2. Here the green line shows the signal strength of local Wi-Fi network and blue line shows the WiMAX Network. As soon as the MS remains in this Wi-Fi network the signal strength does not drops further as the signal strength of Wi-Fi network is higher than WiMAX network.

Signal Strength for WIMAX and Wi-Fi Networks (Case 2)

In this particular network the MS is moving outside the network (BS) at speed 15m/s and enters a Wi-Fi network, the probabilistic vector for the distance is (.2) 200 m. As the MS moves away the signal strength goes on decreasing from higher value of -80dbm w.r.t. vector distance. Handover occurs to Wi-Fi network when the signal strength of BS decreases considerably to a lower level approx. -94dbm and when the signal strength of Wi-Fi network is higher than the WiMAX network. The obtained results show a throughput error value 25 and BER value is 0.0772.

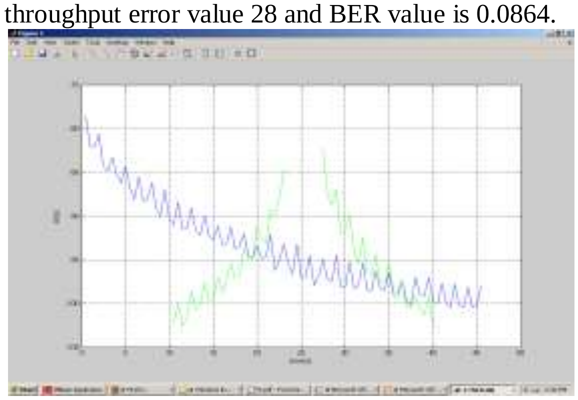


Signal Strength for WiMax and Wi-Fi Network

As we can see in figure, the signal strength is shown of both the Wi-Fi and the WiMAX networks. Here the green line shows the Wi-Fi network that represents the signal strength of local Wi-Fi network and blue line shows the WiMAX Network. As we can see as the distance vector increases and MS goes away from BS the signal strength goes low but if it remains in Wi-Fi network the signal strength does not drops further.

Signal Strength for WIMAX and Wi-Fi Networks (Case 3)

In this particular network the MS is moving outside the network (BS) at speed 20m/s and enters a Wi-Fi network, the probabilistic vector for the distance is (.3) 300 m. As the MS moves away the signal strength goes on decreasing from higher value of -80dbm w.r.t. vector distance. Handover occurs to Wi-Fi network when the signal strength of BS decreases considerably to a lower level approx. -94dbm and the signal strength of Wi-Fi network is higher than the WiMAX network. The obtained results show a throughput error value 28 and BER value is 0.0864.

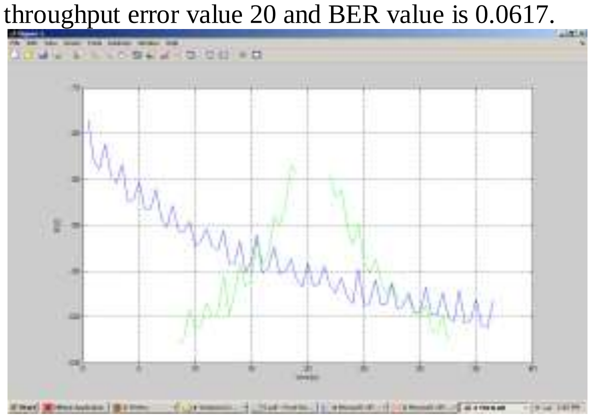


Signal Strength for WiMax and Wi-Fi Network

As we can see in figure, the signal strength is shown of both the Wi-Fi and the WiMAX networks. Here the green line shows the Wi-Fi network that represents the signal strength of local Wi-Fi network and blue line shows the WiMAX Network. As we can see as the distance vector increases and MS goes away from BS the signal strength goes low but if it remains in Wi-Fi network the signal strength does not drops further.

Signal Strength for WIMAX and Wi-Fi Networks (Case 4)

In this particular network the MS is moving outside the network (BS) at speed 25m/s and enters a Wi-Fi network, the probabilistic vector for the distance is (.4) 400 m. As the MS moves away the signal strength goes on decreasing from higher value of -80dbm w.r.t. vector distance. Handover occurs to Wi-Fi network when the signal strength of BS decreases considerably to a lower level approx. -94dbm and the signal strength of Wi-Fi network is higher than the WiMAX network. The obtained results show a throughput error value 20 and BER value is 0.0617.

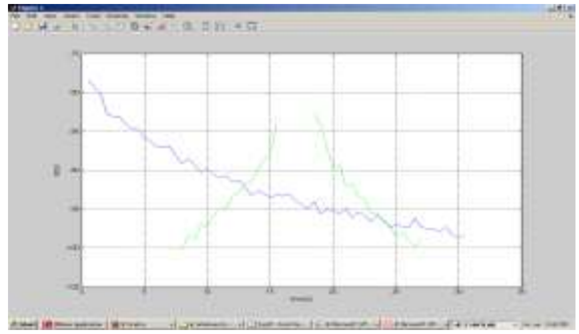


Signal Strength for WiMax and Wi-Fi Network

As we can see in figure, the signal strength is shown of both the Wi-Fi and the WiMAX networks. Here the green line shows the Wi-Fi network that represents the signal strength of local Wi-Fi network and blue line shows the WiMAX Network. As we can see as the distance vector increases and MS goes away from BS the signal strength goes low but if it remains in Wi-Fi network the signal strength does not drops further.

Signal Strength for WIMAX and Wi-Fi Networks (Case 5)

In this particular network the MS is moving outside the network (BS) at speed 30m/s and enters a Wi-Fi network, the probabilistic vector for the distance is (.5) 500 m. As the MS moves away the signal strength goes on decreasing from higher value of -80dbm w.r.t. vector distance. Handover occurs to Wi-Fi network when the signal strength of BS decreases considerably to a lower level approx. -94dbm and the signal strength of Wi-Fi network is higher than the WiMAX network. The obtained results show a throughput error value 28 and BER value is 0.0741.

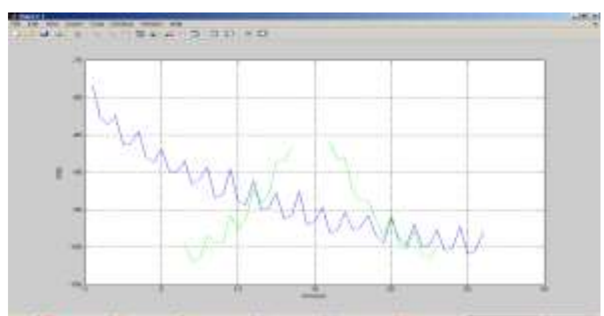


Signal Strength for WiMax and Wi-Fi Network

As we can see in figure, the signal strength is shown of both the Wi-Fi and the WiMAX networks. Here the green line shows the Wi-Fi network that represents the signal strength of local Wi-Fi network and blue line shows the WiMAX Network. As we can see as the distance vector increases and MS goes away from BS the signal strength goes low but if it remains in Wi-Fi network the signal strength does not drops further.

Signal Strength for WIMAX and Wi-Fi Networks (Case 6)

In this particular network the MS is moving outside the network (BS) at speed 35m/s and enters a Wi-Fi network, the probabilistic vector for the distance is (.6) 600 m. As the MS moves away the signal strength goes on decreasing from higher value of -80dbm w.r.t. vector distance. Handover occurs to Wi-Fi network when the signal strength of BS decreases considerably to a lower level approx. -94dbm and the signal strength of Wi-Fi network is higher than the WiMAX network. The obtained results show a throughput error value 25 and BER value is 0.0772.



Signal Strength for WiMax and Wi-Fi Network

As we can see in figure, the signal strength is shown of both the Wi-Fi and the WiMAX networks. Here the green line shows the Wi-Fi network that represents the signal strength of local Wi-Fi network and blue line shows the WiMAX Network. As we can see as the distance vector increases and MS goes away from BS

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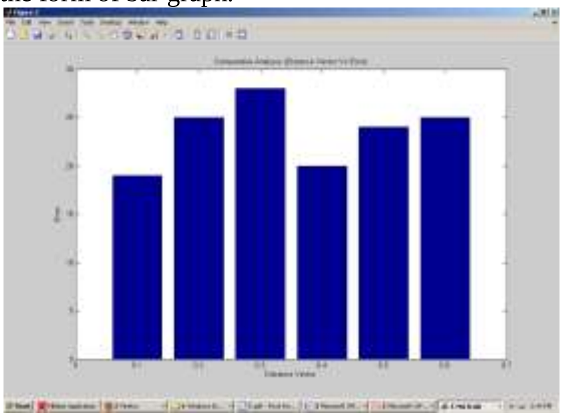
the signal strength goes low but if it remains in Wi-Fi network the signal strength does not drops further.

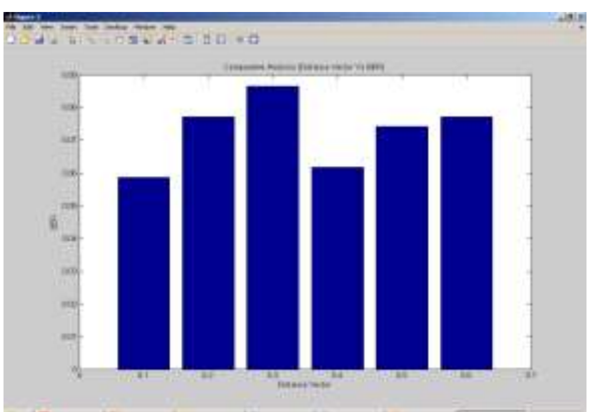
Result Analysis

We have performed the vertical handoff at different speed of mobile nodes and different distance vectors and derive the results in the form of throughput error and the BER ratio. The analysis is here presented in the form of bar graph.



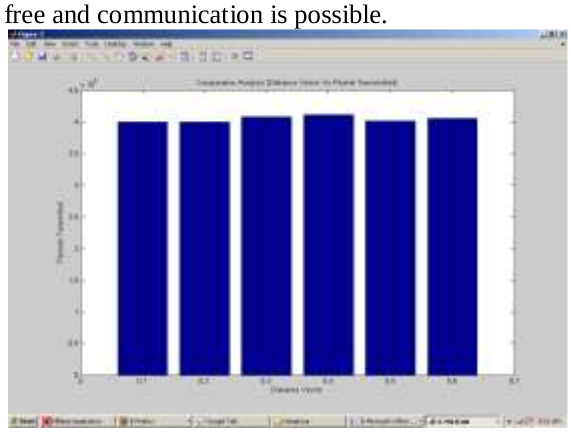
Error Analysis

As we can see in figure, the result is analyzed at different mobile speed and the distance vectors. Here we can see that at the initial stage as when the node is present in parent network having higher signal strength the throughput error value is less and as distance vector increases and node moves away from coverage area there are more chances of error occurrence and the error value increases. But when the node enters in higher signal strength network (Wi-Fi) the value of throughput error decreases again, showing a efficient handover between Wi-Fi and WIMAX networks but it is influenced by other factors also such as mobile node speed, load etc. Because of this the error rate can be reduced if the slots are free and communication is possible.



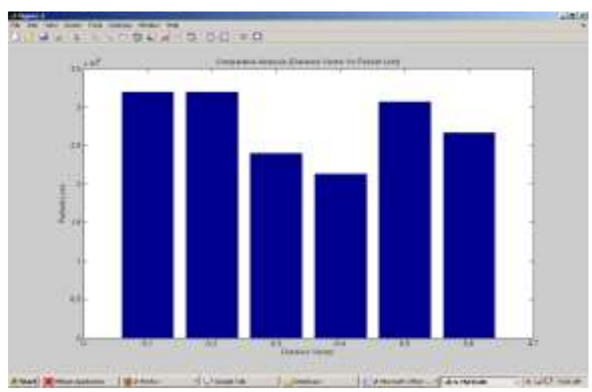
BER Analysis

As we can see in figure 5.9 the result is analyzed at different mobile speed and the distance vectors. Here we can see that at the initial stage when the node is present in parent network having higher signal strength the BER (Bit Error Rate) is very small but as the distance vector increases and the node starts moving away the BER value increases. But when the MS enters a Wi-Fi network having higher signal strength than the parent network the chances of transmission of erroneous bits reduced and BER value decreases also. But it is influenced by other factors also such as mobile node speed, load etc. Because Bit Error Rate can be reduced if the slots are free and communication is possible.



Throughput Analysis

As we can see in figure 5.10 the result is analyzed at different mobile speed and the distance vectors. As we can see, there is slight change in the throughput during the handover process. The throughput is been maximum when the mobile node is moving at an average seep of 20 to 30 m/s. But when the speed is less or the more than that some data loss occur during the handover process. We can here conclude that the mobility of the node during the handover process will affect the throughput over the network.



Packet Loss Analysis

As we can see in figure 5.11 the result is analyzed at different mobile speed and the distance vectors. As we can see, there is slight change in the packet loss during the handover process. The throughput is been

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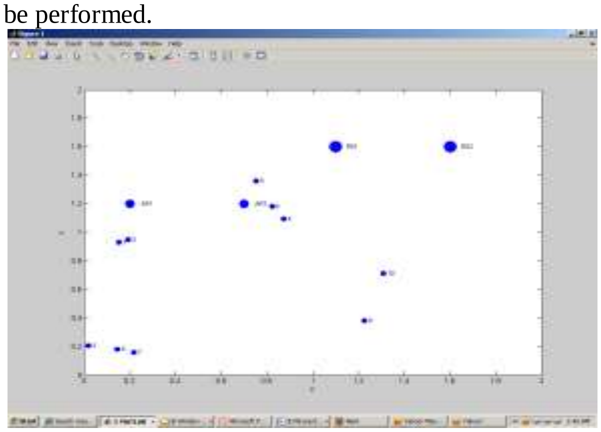
minimum when the mobile node is moving at an average seep of 20 to 30 m/s. But when the speed is less or the more than that some data loss occurs during the handover process. We can here conclude that the mobility of the node during the handover process will affect the data loss over the network.

Results

The figure is showing the network with two wimax networks with n number of nodes and two base stations. To show the concept of heavy load we have taken a multicast communication. The node will move from one network to other and the handoff will be performed.

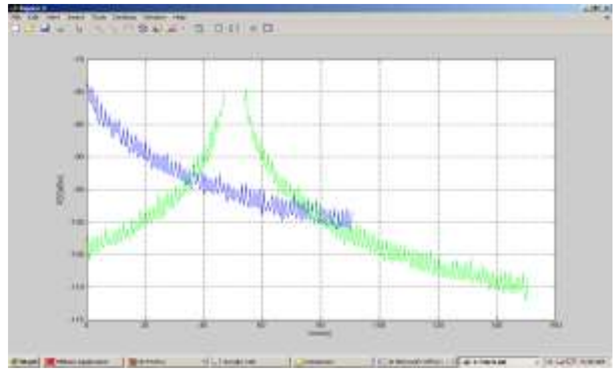


Network Setup

As we can see the hybrid network with n mobile stations and 2 base stations one for the Wi-Fi network and WiMAX network. The basic parameters considered here for the handoff analysis are Mobile Node Speed and the Distance vector. The results are driven in the form of error and the BER detection for the network.

Signal Strength for two Wimax Networks Networks (Case 1)

In this particular network the MS is moving outside the network (BS) at speed 10m/s and move outside the network, the probabilistic vector for the distance is (.1) 100 m. As the MS moves away the signal strength goes on decreasing from higher value of -80dbm w.r.t. vector distance. The handover process will be performed respective to the signal strengthen, the base station that will provide the higher signal strength will get the control over the node. During the handover process we observe that the ber is 0.0772 and error rate is 25. We can see the Wi-Fi will provide the less error rate in case of horizontal handover.

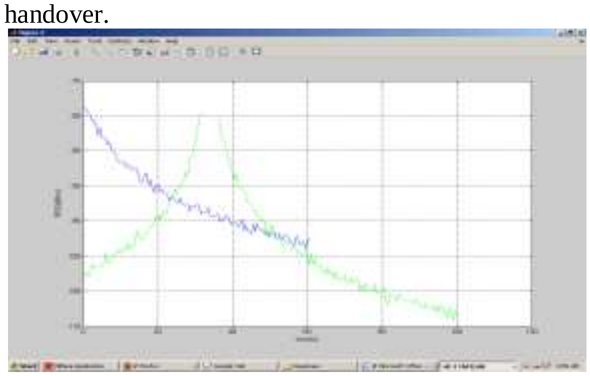


Signal Strength for Two WiMax Network

The strength of the signals for the two WiMAX network is shown in figure 5.13. Here the green line shows the signal strength of one WiMax network and blue line shows the other WiMAX Network. As soon as the MS remains in this its actual network the signal strength does not drops further as the signal strength of second WiMax network is higher.

Signal Strength for Two WIMAX Networks (Case 2)

In this particular network the MS is moving outside the network (BS) at speed 15 m/s and move outside the network, the probabilistic vector for the distance is (.2) 200 m. As the MS moves away the signal strength goes on decreasing from higher value of distance vector. The handover process will be performed respective to the signal strengthen, the base station that will provide the higher signal strength will get the control over the node. During the handover process we observe that the ber is 0.0772 and error rate is 25. We can see the Wi-Fi will provide the less error rate in case of horizontal handover.



Signal Strength for Two WiMax Networks

The strength of the signals for the two WiMAX network is shown in figure 5.14. Here the green line shows the signal strength of one WiMax network and blue line shows the other WiMAX Network. As soon as the MS remains in this its actual network the signal strength does not drops further as the signal strength of second WiMax network is higher.

Signal Strength for Two WIMAX Networks (Case 3)

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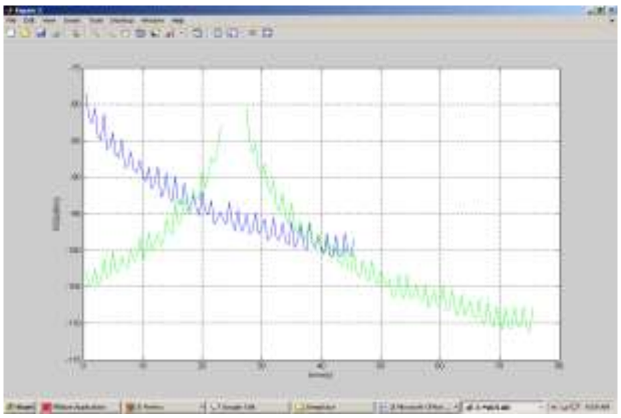
In this particular network the MS is moving outside the network (BS) at speed 20 m/s and move outside the network, the probabilistic vector for the distance is (.3) 300 m. As the MS moves away the signal strength goes on decreasing from higher value of distance vector. The handover process will be performed respective to the signal strengthen, the base station that will provide the higher signal strength will get the control over the node. During the handover process we observe that the ber is 0.0864 and error rate is 28. We can see the Wi-Fi will provide the less error rate in case of horizontal handover.

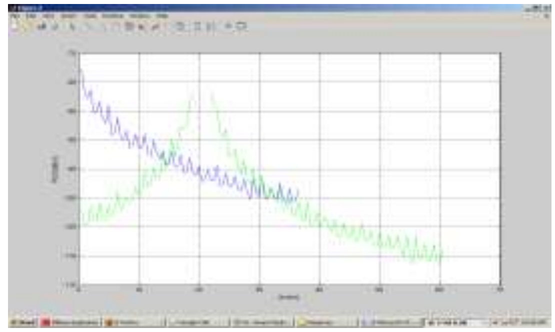


Signal Strength for Two WiMax Networks

The strength of the signals for the two WiMAX network is shown in figure 5.15. Here the green line shows the signal strength of one WiMax network and blue line shows the other WiMAX Network. As soon as the MS remains in this its actual network the signal strength does not drops further as the signal strength of second WiMax network is higher.

Signal Strength for Two WIMAX Networks (Case 4)

In this particular network the MS is moving outside the network (BS) at speed 25 m/s and move outside the network, the probabilistic vector for the distance is (.4) 400 m. As the MS moves away the signal strength goes on decreasing from higher value of distance vector. The handover process will be performed respective to the signal strengthen, the base station that will provide the higher signal strength will get the control over the node. During the handover process we observe that the ber is 0.0525 and error rate is 17. We can see the Wi-Fi will provide the less error rate in case of horizontal handover.

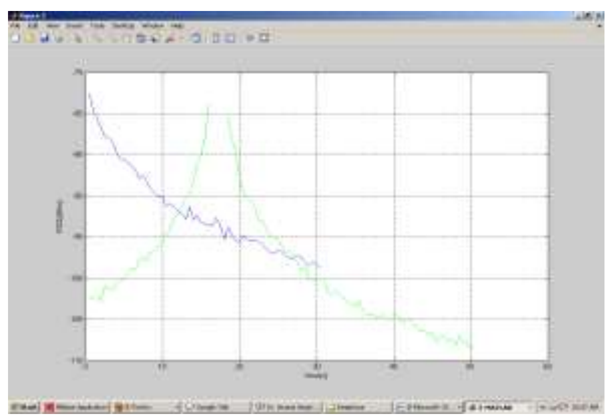


Signal Strength for Two WiMax Networks

The strength of the signals for the two WiMAX network is shown in figure 5.16. Here the green line shows the signal strength of one WiMax network and blue line shows the other WiMAX Network. As soon as the MS remains in this its actual network the signal strength does not drops further as the signal strength of second WiMax network is higher.

Signal Strength for Two WIMAX Networks (Case 5)

In this particular network the MS is moving outside the network (BS) at speed 25 m/s and move outside the network, the probabilistic vector for the distance is (.4) 400 m. As the MS moves away the signal strength goes on decreasing from higher value of distance vector. The handover process will be performed respective to the signal strengthen, the base station that will provide the higher signal strength will get the control over the node. During the handover process we observe that the ber is 0.0556 and error rate is 18. We can see the Wi-Fi will provide the less error rate in case of horizontal handover.

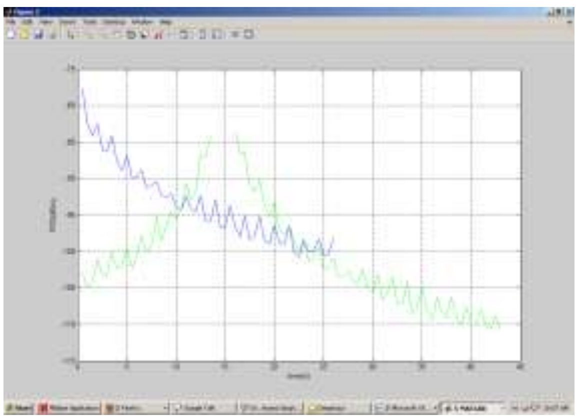


Signal Strength for Two WiMax Networks

The strength of the signals for the two WiMAX network is shown in figure 5.17. Here the green line shows the signal strength of one WiMax network and blue line shows the other WiMAX Network. As soon as the MS remains in this its actual network the signal strength does not drops further as the signal strength of second WiMax network is higher.

***Signal Strength for Two WIMAX Networks (Case 6*)**

In this particular network the MS is moving outside the network (BS) at speed 35m/s and enters a Wi-Fi network, the probabilistic vector for the distance is (.6) 600 m. As the MS moves away the signal strength goes on decreasing from higher value of -80dbm w.r.t. vector distance. Handover occurs to Wi-Fi network when the signal strength of BS decreases considerably to a lower level approx. -94dbm and the signal strength of Wi-Fi network is higher than the WiMAX network. The obtained results show a throughput error value 20 and BER value is 0.0617.

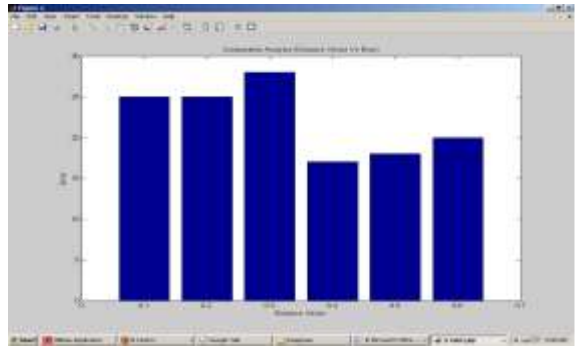


Signal Strength for Two WiMax Networks

The strength of the signals for the two WiMAX network is shown in figure 5.18. Here the green line shows the signal strength of one WiMax network and blue line shows the other WiMAX Network. As soon as the MS remains in this its actual network the signal strength does not drops further as the signal strength of second WiMax network is higher.

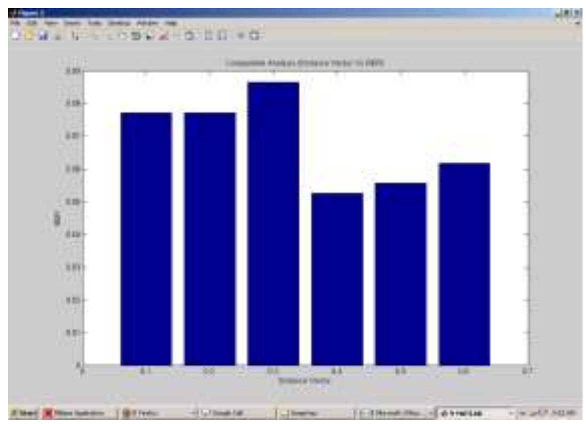
Result Analysis

We have performed the vertical handoff at different speed of mobile nodes and different distance vectors and derive the results in the form of throughput error and the BER ratio. The analysis is here presented in the form of bar graph.



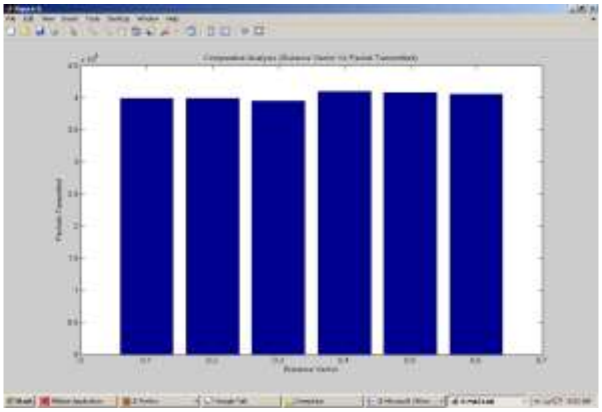
Error Analysis

As we can see in figure, the result is analyzed at different mobile speed and the distance vectors. As we can see, as the handover process is performed to a strong signal wimax network the error rate is reduced.



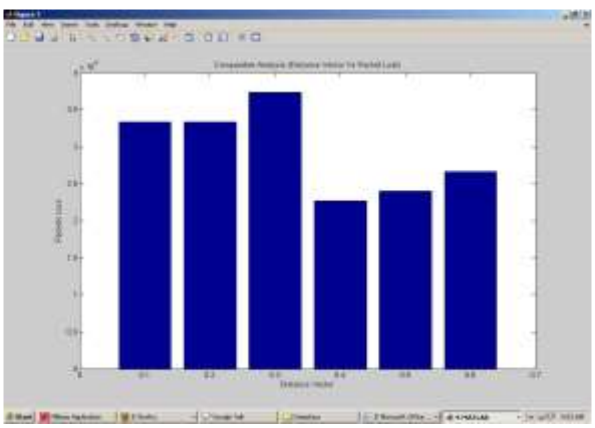
BER Analysis

As we can see in figure 5.20 the result is analyzed at different mobile speed and the distance vectors. Here we can see that at the initial stage when the node is present in parent network having higher signal strength the BER (Bit Error Rate) is very small but as the distance vector increases and the node starts moving away the BER value decreases. It means if the network is having the strong signals, the speed and distance ratio will not increase the BER rather than with successful handover the BER will be decreased



Throughput Analysis

As we can see in figure, the result is analyzed at different mobile speed and the distance vectors. As we can see, there is slight change in the throughput during the handover process. The throughput is been maximum when the mobile node is moving at an high speed of 35 to 35 m/s. But when the speed is less or the more than that some data loss occur during the handover process. We can here conclude that the mobility of the node during is not the major factor if a strong signal base station is there.



Packet Loss Analysis

As we can see in figure, the result is analyzed at different mobile speed and the distance vectors. As we can see, there is slight change in the packet loss during the handover process. The throughput is been minimum when the mobile node is moving at an average seep of 25 to 35 m/s. But when the speed is less or the more than that some data loss occur during the handover process. We can here conclude that the mobility of the node during the handover process will be decreased if the strong signal base station is there.

CONCLUSION

A Hybrid network architecture supports all usage models (fixed, mobile & nomadic). It is also support high capacity real time and non real time voice, data and multimedia services while maintaining the appropriate QoS. Moreover it supports idle mode operation and paging for the mobile station. Its network reference model support interoperability.By comparing the Proposed Handover Approach and Existing and, we observed that Proposed Handover Approach offers better services than the Existing Approach. Its network can be a good choice to fill up the gap between the Existing. Here we combine 3 parameters while performing the handover Load on Base Station, Distance and the Transmission Time. In this proposed work we have performed the work on both the horizontal handover and the vertical handover with effect of distance, speed etc. The result analysis is driven in terms of packet transmitted, packet lost, BER and the error rate. We can see that the always a strong signal Base station take the charge of the node that moves outside its coverage area. Either it is a Wi-Fi or the Wimax Network. The effect of the mobility and the distance is observed very carefully in this work. As we can see, as the speed of the mobile node increases, the error rate is also increased.

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